West Point Oct. 12th. 1844

My dear Friend

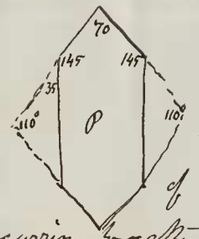
I feel under too many obligations to you, not to endeavour to make some effort to comply with your wishes expressed in your last letter, and therefore although greatly pressed, at this time of the year, with multifarious business, I have forced out time enough to send you some rude sketches of the crystals in plants.

My studies thus far have been chiefly confined to di-cotyledonous plants and among the results are the following

In the great majority of di-cot.s trees, shrubs and many herbs there occur vast quantities of crystals which are occasionally as in Rosa rubiginosa unmodified oblique rhombic prisms (fig 1) but more generally the same form with the acute basal edges (e e) replaced. (fig 2 to 11) The plane angles of the faces M. are about 70° and ~~110~~ 110° as given by a great number of measurements in plants of many different families Crystals of this form occur abundantly in all Leguminosae, Rosaceae, Coniferae, Betulaceae, Ulmaceae Aurantiaceae &c also in Pinus, Platanus, Xanthoxyllum, Ailanthus, Swietiana, Guiacum and a vast number of Mens. I have not found them in Compositae, nor Cruciferae Twin crystals fig 12. 13 are very common, they are particularly large in the bark of cherry — These crystals may be seen in situ in thin sections of the inner bark of Locust-chesnut, oak, willow &c and present a beautiful mosaic of gems (particularly beautiful by polarized light) — These crystals agree in form and composition, My experiments appear to show conclusively that they are composed of Oxalate of Lime.

A second form less common, among Di-cotyledons is shown in figs 15 to 19 They are long prisms with the lateral planes at right angles, but the oblique terminal planes prove that they belong to the same system (Monoclinate) with the preceding — The plane angles on one face are shown here

— This form (single fig 15. 16 & 19) — (twin fig 17 & 18,) (and in bunches fig 20 & 21) is common in Carya, Juglans, Bumelia and a few other Dicot.s also variously modified in all the Iris tribe among Monocot.s You will see by the annexed figure next page that the plane angles 70.° 145.° 145° at one end of the plane are just those which would be given on plane P of the forms fig 2 &c mentioned if planes were passed cutting off the



structure lateral edges thus, to be altered by an oblique

– the plane angles at the other end however appear intersection of the plane P. with some intermediate plane

From the correspondence of the above mentioned plane angles, and from the 2

kinds of forms sometimes occurring together I am induced to believe that they may be modifications of the same primary. In chemical action both agree with the belief that they are composed of Oxalate of Lime – Both forms produce bunches of crystals (conglomerate raphides) fig 20. 21, and these bunches often occur in plants where the single crystals cannot be detected – Barks are particularly abundant in Polygonaceæ, Malvaceæ, many Urticaceæ &c. Rows of these bunches may be seen beautifully in the axles of the leaf of Salisburia adiantifolia, ~~Acer~~ scattered in vast quantities in leaf of Nelumbo, also scattered in leaf of Carya, Salix white single crystals of the first form fig 2, are placed in rows along the midrib and principal veins –

The bunches in Rhubarb and many other plants have been analyzed and prove to be Oxalate of Lime –

The number of crystals of form fig 2 is truly astonishing – in fig 14 from Locust you will see that each cell has its crystal – The cell average $\frac{1}{1250}$ th of an inch in size, and taking two layers of these cells (one to make up for the mesh work in the other) it follows that in a square inch of the $\frac{1250}{1250}$ liber of locust no thicker than a sheet of paper there must be 1250×1250 or $\frac{1250}{1250}\frac{62500}{1500}\frac{1562500}{}$ or more than 1½ million of crystals – These crystals exist not only in bark and leaves, but also in wood of trunk and root.

Some forms not referable to any above mentioned by me were found in a few dicotyledons, thus octahedral and square prismatic forms were found in Rhus – very minute cubes in cells of liber of potato, among the starch globules (see fig 23) – These I have not yet analyzed – neither have I studied the acicular raphides so common in Onagrarieæ – Vitaceæ among Dicotyledons and also found in vast quantities in Monocotyledons

I would mention however that the "biforines of Turpin" are present in all Aroideæ and may be taken out from leaves long dried in herbaria and made to discharge the raphides by moistening them

Elliptical vesicles precisely like the biforines in form are common in Pontederia, but I have not made them discharge their raphides –

The figures I send were all drawn by Camera-lucida to the same scale, which is annexed in fig 24 which represents $\frac{10}{100}$ ths of a millimetre equally magnified with the sketches – Should you have any of these figures engraved tell the engraver to make all the lines of the crystals straight and smooth – In tracing them off I have made them rough and have not time to correct faults –

As Silliman is to publish my memoir in crystals in his next January number I think it would hardly be fair to ~~print~~ publish these results prior to the appearance in his journal, but if your text book is not to appear until after that period you can use these freely – If sooner let me know and I will arrange matters with him so that I think he will not object.

I am very anxious to see Payens paper – I have only seen meagre abstracts which appear to contain important errors of translation.

I have all the experiments on Hydrogen to show to day – Do excuse haste

and believe me ever

most truly Yr friend

J. W. Bailey

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